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Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

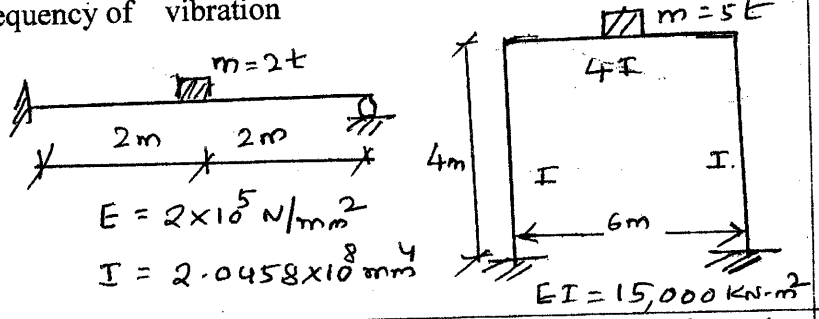
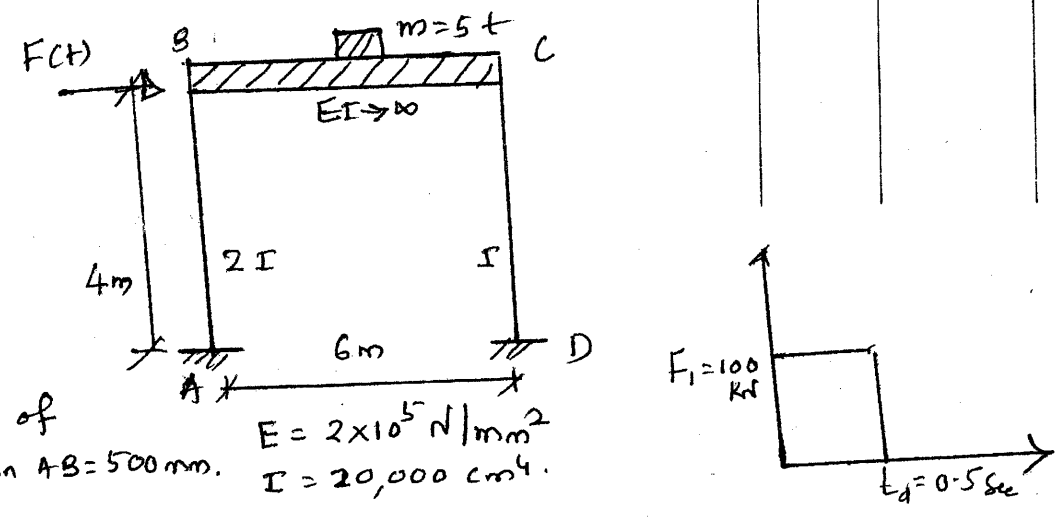
(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.
End Semester Exam
November 2016

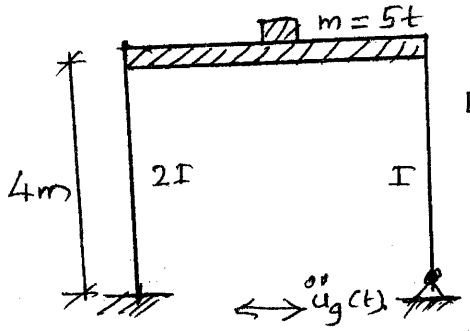
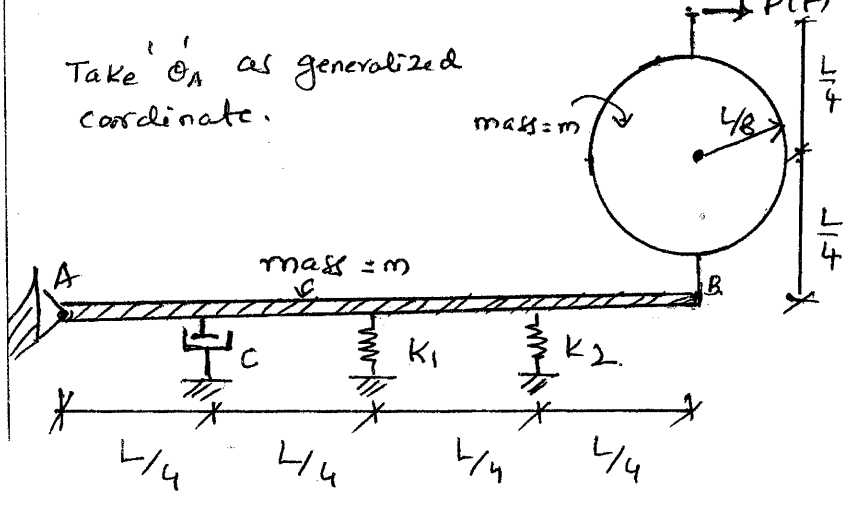
Max. Marks: 100 Duration: 4 Hours
Class: M.Tech. Semester: I Program: Civil Engineering with Structural Engineering
Name of the Course: Structural Dynamics Course Code : MTST102

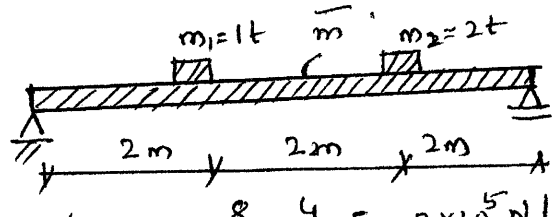
Master file.

Instructions:

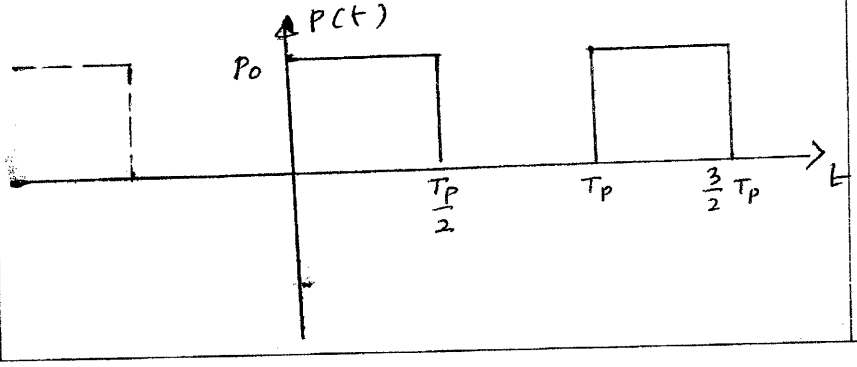
- Attempt any FIVE questions out of SEVEN questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Assume suitable data if necessary and state the same clearly.

Question No		Max. Marks	Course Outcome No.	Module No.
Q 1 (a)	**(i)** Define Dynamic load. Distinguish between Prescribed and Random dynamic loads	3	1	1
	(ii) Define Damping and state the effects of damping.	2	1	2
Q 1(b)	For the structural systems shown in figure compute the natural frequency of vibration 	7	2	2
Q 1 (c).	The frame shown in figure is subjected to a rectangular pulse type load as shown in figure at girder level. Calculate the maximum horizontal displacement at girder level and maximum bending moment in column AB  Depth of column AB = 500 mm.	8	2	2

Q 2 (a)	The mass m, stiffness k, and natural frequency ω of an undamped system are unknown. These properties are to be determined by harmonic excitation tests. At an excitation frequency of 4 Hz, the repose tends to increase without bound (i.e, a resonant condition). Next, a weight Δw = 50 N is attached to the mass m and the resonance test is repeated. This time resonance occurs at f = 3 Hz. Determine the mass and the stiffness of the system.	**5**	**2**	**2**
Q2 (b)	A rigid steel frame shown in figure is subject to harmonic ground motion with amplitude of ground acceleration 0.2g and frequency 1.2 times the frequency of structure. Assuming the ratio as 2%, determine the maximum displacement at girder level. Also find maximum stress in each column. 	**8**	**2**	**2**
Q2 (c)	A machine weighing 25 KN exerts harmonic force 4000 N amplitude, at 10 Hz at its supports. After installing the machine on a spring type isolator, the force exerted on the support is reduced to 400 N. Determine the spring stiffness K. The damping ratio ξ = 10%	**7**	**2**	**2**
Q3	For the rigid body system shown in figure: (a) Formulate the equation of motion (b) Determine the natural frequency and damping ratio (c) Determine the displacement response u(x, t) due to p(t)= P_0, a suddenly applied constant load (d) Evaluate the maximum response u(x) Take θ_A as generalized coordinate.  K_1 = 1000 KN/m K_2 = 500 KN/m m = 100 kg . L = 2 m. C = 0.5 N-S/m. P_0 = 50 KN.	**20**	**2**	**3**

<table>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Q 4</td><td>A three storey single bay frame has storey height of 4 m. each. The columns ground and first storey are of size 300 mm wide X 750 mm deep while the columns at second storey are 300 mm wide X 600 mm deep & beams are very stiff. The mass on the first and second floor is 30 t & on third floor is 25 t. E = 20000 Mpa. Calculate natural frequencies & mode shapes.</td><td>20</td><td>2</td><td>4</td></tr>
<tr><td>Q 5 (a)</td><td>State and prove orthogonality principle. Also state the significance of orthogonality principle in dynamic analysis</td><td>5</td><td>2</td><td>4</td></tr>
<tr><td>Q 5 (b)</td><td>A three storey frame with free vibration characteristics as given below is subjected to a harmonic force with amplitude 60KN and frequency 20 rad/sec. at the 2nd and 3rd floor level. Calculate maximum displacements of each storey. Take damping ratio =5%
<table>
<tr><td rowspan="2">Storey No.</td><td rowspan="2">Mass No.</td><td rowspan="2">Mass (t)</td><td rowspan="2">ω rad/sec</td><td colspan="3">Mode shapes</td></tr>
<tr><td>Φ_{i1}</td><td>Φ_{i2}</td><td>Φ_{i3}</td></tr>
<tr><td>1</td><td>1</td><td>20</td><td>15.73</td><td>0.399</td><td>0.747</td><td>1.0</td></tr>
<tr><td>2</td><td>2</td><td>20</td><td>49.85</td><td>1.0</td><td>0.727</td><td>-0.471</td></tr>
<tr><td>3</td><td>3</td><td>20</td><td>77.82</td><td>-0.908</td><td>1.0</td><td>-0.192</td></tr>
</table></td><td>15</td><td>2</td><td>4</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Q 6(a)</td><td>For the beam shown in figure calculate the fundament frequency using Rayleigh's Method.
 

$\bar{m} = 200\ kg/m$ $I = 10^8\ mm^4$ $E = 2\times10^5\ N/mm^2$</td><td>10</td><td>2</td><td>2</td></tr>
<tr><td>Q 6(b)</td><td>A simply supported beam of 6m span, 300 mm wide 600 mm deep carries a suddenly applied force of 50 KN at 2m from left support and 100KN at centre. Calculate the maximum displacement and bending moment responses at mid span and shear force at left support. E= $2x10^4$ Mpa. and density of material = 2500 kg/m^3. Take contribution from the four lowest contributing modes</td><td>10</td><td>2</td><td>5</td></tr>
</table>

Q 7(a)	What is transmissibility of a system? Briefly explain how vibration isolation can be achieved	5	2	2
Q 7(b)	Explain the following in connection with random process: (i) Random process (ii) Random variable(discrete and continuous) (iii) Probability distributions (iv) Power spectral density functions (v) Auto correlation functions	5	3	6,7
Q 7(c)	Determine the Fourier Representation of the periodic load shown in figure (response calculation is not required) 	10	2	2

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End Semester Exam

November 2016

Max. Marks: 100 Duration: 4 Hours

Class: M.Tech Semester: I Program: M.Tech (Civil) with Structural Engineering Courses

Name of the Course: Non Linear Analysis Course Code : MTST 103

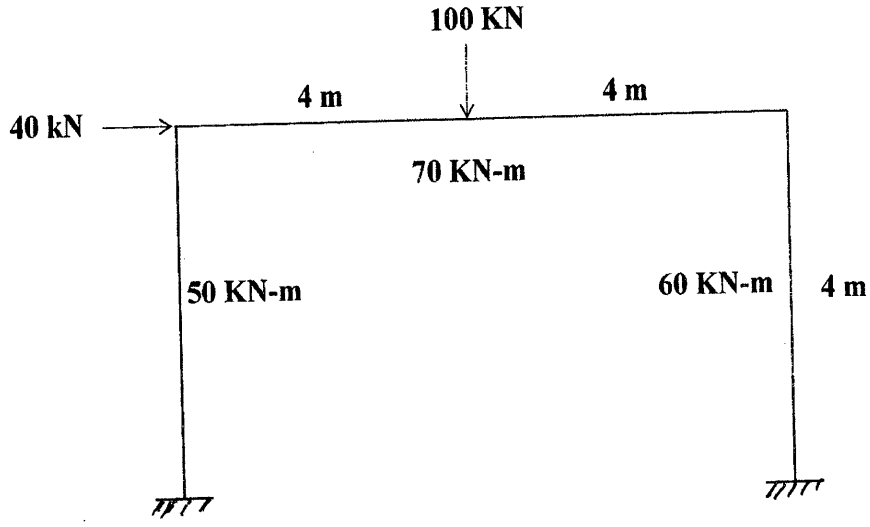
Master file.

Instructions:

- Attempt any FIVE questions out of SEVEN questions.
- **Answers to all sub questions should be grouped together.**
- Figures to the right indicate full marks.
- Assume suitable data if necessary and state the same clearly.

Question No		Max Marks	Course Outcome Number	Module No.
Q.1 (a)	Write a note on Primary (Basic) mechanisms.	(05)	1	2
Q.1 (b)	Write a note on different approaches for the buckling analysis of a column.	(05)	3	4
Q.1 (c)	How is a solid section different from a thin walled open section when subjected to axial load? Explain	(05)	4	6
Q.1 (d)	In case of lateral buckling of rectangular beam in pure bending, write the expression for critical stress and explain the terms involved in the expression.	(05)	4	7
Q.2 (a)	A propped cantilever of span 6 m is subjected to a udl of 15 kN/m on the entire span. Find the moment capacity of the beam required. Take load factor=1.5.	(10)	1	1
Q.2 (b)	Find the shape factor of an unsymmetrical I section with following details: Top flange 350 mm wide & 20 mm deep Web 15 mm wide & 200 mm deep Bottom flange 300 mm wide & 20 mm deep	(10)	1	1

Q.3 (a) For the frame shown in figure below, find the collapse load factor. Loads shown in the figure are working loads and the plastic moment capacity of each member in KN-m is also shown in the figure. (14) 1 2



Q.3 (b) Explain different possible mechanisms for a simple gable frame. (06) 1 2

Q.4 (a) A three span continuous beam ABCD (Support A is hinged, supports B, C and D are on roller support) where AB= 4m, BC=6m, CD=5m. It carries a central point load of 30 KN on span AB, a udl of 10 KN/m on span BC, and a point load of 40 KN at 2m to the right of support C. If the beam is to have uniform section throughout, find the plastic moment capacity of the section required. (10) 1 1

Q.4 (b) Write a note on effect of shear force on plastic moment capacity of a flexural member. (10) 2 3

Q.5 (a) A simply supported column of length L is under the action of a compressive load P. Find the critical load by finite difference method if the flexural stiffness of the member varies according to (10) 3 4

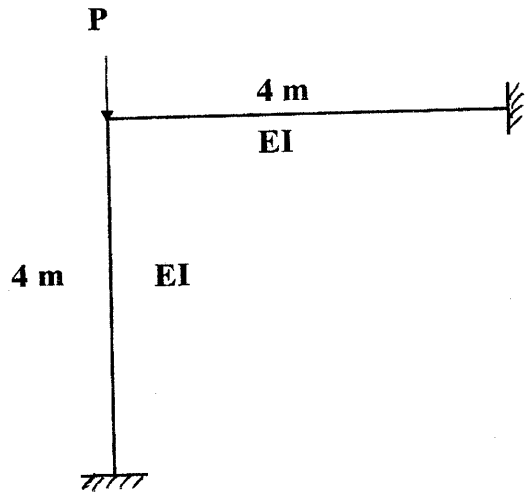
$EI(x) = EI_0 \quad 0 \le x \le L/3$

$= 2EI_0 \quad L/3 \le x \le 2L/3$

$= EI_0 \quad 2L/3 \le x \le L$.

Q.5 (b) Use energy method and find the critical load of the column given in Question No 5 (a) above. (10) 3 4

Q.6 (a) Determine the critical load for the frame shown in figure. (15) 3 5



Q. 6 (b) What is a beam column? Explain (05) 3 5

Q.7 (a) Derive the governing differential equation for the torsional buckling of column with doubly symmetrical cross- section. (14) 4 6

Q.7 (b) Write a note lateral buckling of beams (06) 4 7

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(3)

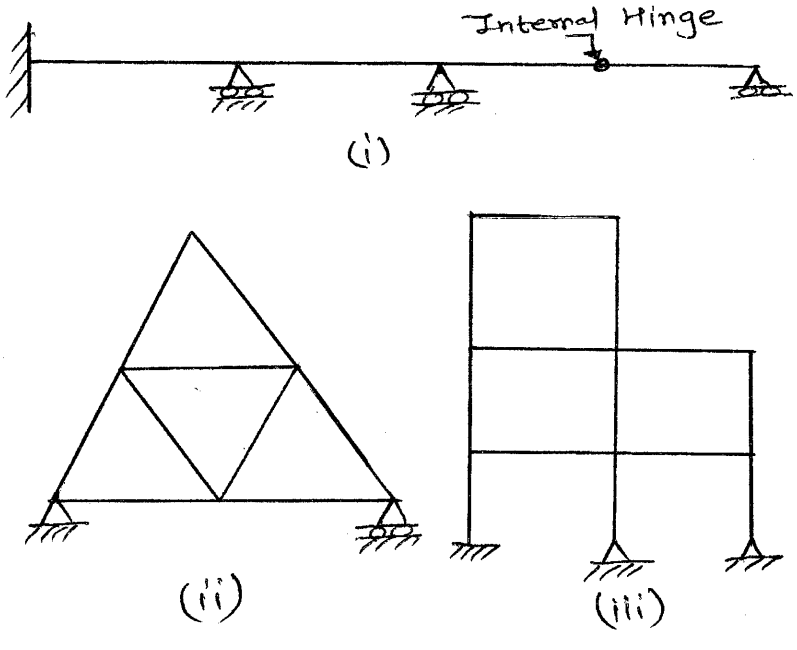
Program: F.Y.M.Tech. (Civil)(Structural Engg)
Course code: MTST104
Name of the Course: Advanced Structural Analysis
Semester: I

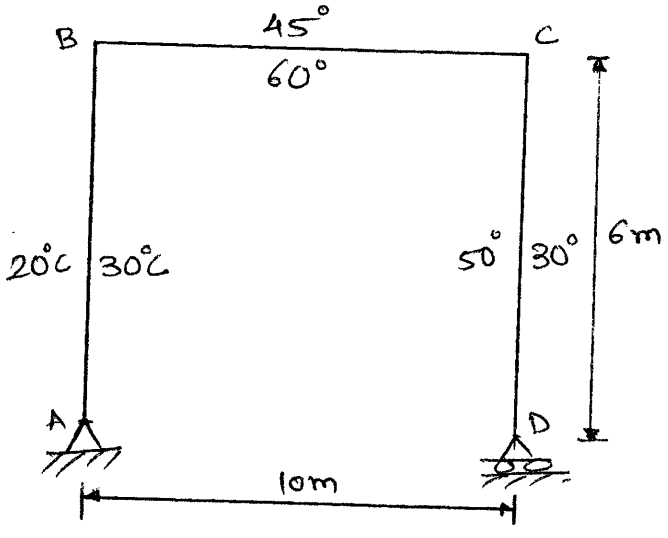
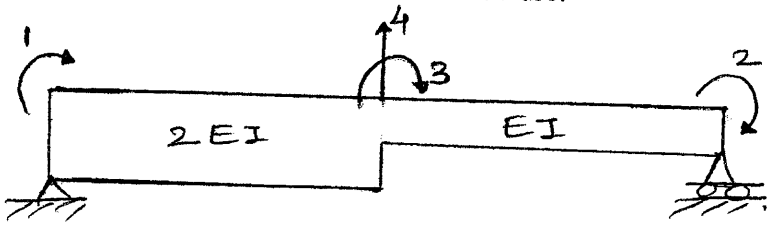
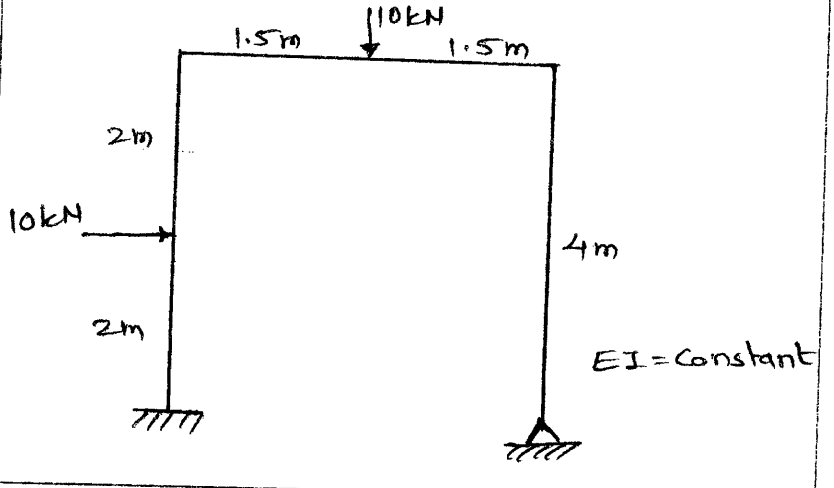
Date: 23/11/2016
Duration : 3 Hr
Maximum Marks : 100

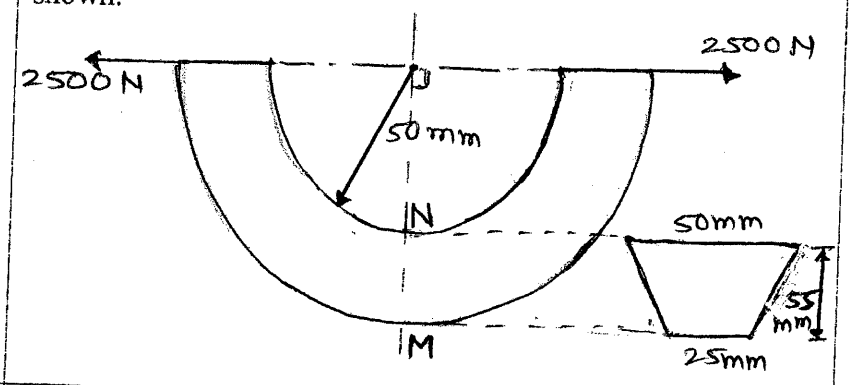
Master file.

Instructions:

1) Question **No.1** is compulsory.
2) Out of remaining questions, attempt any **FOUR** questions.
3) In all **FIVE** questions to be attempted.
4) All questions carry equal marks.
5) Answers to each question to be started on fresh page.

Q. No.		Maximum Marks	Course Outcome Number	Module No.
Q.1 a)	Determine the static indeterminacy (external, internal abd total) and kinematic indeterminacy (including and excluding axial deformation) for the structures shown below: 	10	1,2	2
Q.1 b)	Differentiate between statically determine structure abd statically indeterminate structure.	6	1,2	1
Q.1 c)	Explain the term stiffness and flexibility.	4	1,2	1

Q.2 a)	For the rigid jointed frame the temperature variations are as shown. Determine horizontal, vertical and resultant deflection of joint C. Depth of member AB = 100 mm Depth of member BC = 300 mm Depth of member CD = 200 mm Take $\alpha = 12 \times 10^{-6}/^{0}$ C. 	10	1	4
Q.2 b)	Generate the stiffness matrix of the structure. 	10	2	2
Q.3 a)	Analyse the portal frame as shown in figure using flexibility method. And BMD for the same. 	10	1	4
Q.3 b)	Derive the expression for the bending stress when the curved beam is loaded in plane of curvature and subjected to sagging bending moment M.	10	3	6
Q.4 a)	Draw flow chart for flexibility analysis of statically determinate structure.	10	1	3

Q.4 b)	Determine the maximum and minimum stresses at section MN of given curved beam having trapezoidal cross section as shown.  	10	3	6
Q.5	Draw flow chart for stiffness analysis of the structure it in a brief.	20	2	3
Q.6	A curved beam forming a circle in plan having 6 support subjected to udl of 20 kN/m and radius 4 m. Determine shear force, bending moment and twisting moment at salient points. Also draw SFD, BMD and TMD for the beam. [$C_1 = 0.089$, $C_2 = 0.045$, $C_3 = 0.009$]	20	3	5
Q.7	Derive the expression of deflection, slope, shear force and bending moment for thr semi-infinite beam subjected to a concentrated load and moment at one finite end.	20	4	7